

Activity 1: Student

Magic Show



“Get ready to take part in the most ‘ELECTRIFYING’ show of the century”

A. The Great “Water Bender”

1. Turn on the water faucet until you get a very thin stream of water.
2. Rub the Magic Wand (ebonite rod) with Dragon’s Beard (fur).
3. Slowly bring the Magic Wand to the thin stream of water, without touching the water.
4. Ta-daa! What did you observe?

B. Dance of the Sugar-Plum Fairies

1. Inflate the Magic Balloon and tie the opening.
2. Rub the Magic Balloon against the magician’s hair while chanting “Abracadabra” ten times.
3. Hold the Magic Balloon above the Tinsel Fairies and watch them dance.
4. Ta-daa! How did the tinsel fairies dance?

C. Invisible Glue

1. Inflate the Magic Balloon and tie the opening.
2. Rub the Magic Balloon against the magician’s hair while chanting “Abracadabra” ten times.
3. Place the Magic Balloon against the wall.
4. Ta-daa! How did it stick?

Activity 2: Student



Electric Charges

Everything in this world is made up of atoms. All atoms consist of protons, electrons and neutrons. Unlike protons and neutrons that reside in the nucleus, electrons are able to move around. An object with a surplus of electrons is negatively charged, while an object with a deficit of electrons is positively charged.

A. Charging by Friction

When we rub two different materials together, this process is known as charging by friction. Since the objects are made of different materials, their atoms will hold on to the electrons with different strengths.

1. Use the following chart to answer the questions below:

Sulphur		Strong Hold on Electrons
Brass		
Copper		
Ebonite		
Paraffin Wax		Increasing tendency to hold on to electrons (negatively-charged)
Silk		
Lead		
Fur		
Wool		Weak Hold on Electrons
Glass		

Explain what happens:

a) When you rub an ebonite rod with fur.

b) When you rub a glass rod with silk.

c) When you rub brass with wool.

B. Charging by Conduction

Conduction describes the process in which two objects come into contact. We will use an **electroscope** to demonstrate charging by conduction. An electroscope is a scientific instrument that detects the presence and magnitude of charges.

1. When the gold leaves are down, the electroscope is neutral. How many electrons compared to protons are in this electroscope? MORE EQUAL LESS
2. Rub the balloon with your hair. In the boxes below, draw what your gold leaves look like and show the distribution of charges in your diagrams:



When the balloon touches the metal knob.



When the balloon moves away from the metal knob.

3. Ground the electroscope by placing your finger on the metal knob.

C. Charging by Induction

Charging by induction describes the process of charging any object without physical contact.

1. Rub the balloon with your hair. In the boxes below, draw what your gold leaves look like and show the distribution of charges:



When one person touches the metal knob and the balloon is brought close to the electroscope.



When the finger is removed but the balloon is still close to the electroscope

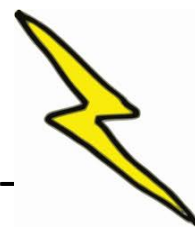


When the balloon is removed from the electroscope.

D. Explanation

Using a separate piece of paper, explain why the electroscope behaved the way it did for Diagrams A-E.

Activity 3: Student



Van de Graaff Demo

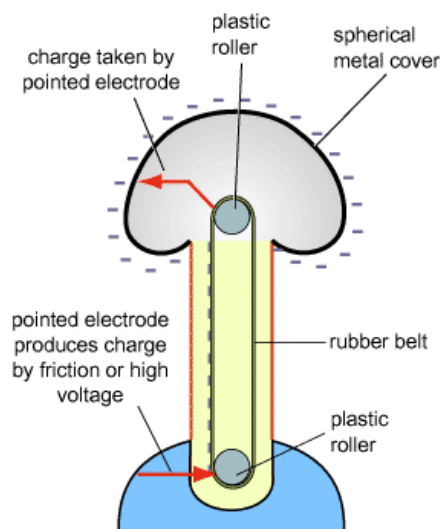
Introduction:

A Van de Graaff generator is a machine that deposits electrical charges on a rubber belt, as the rubber belt turns it re-deposits the electrical charges up in the metal ball. The accumulation of electrical charges produces a static electricity that exceeds 100,000 volts! It works a lot like scuffing your shoes on a carpet on a dry day.

Safety Precautions:

1. Remove all electrical devices.
2. Do NOT create human chains.
3. Students with heart problems should not come in contact with the generator.

Diagram:



Static Electricity:

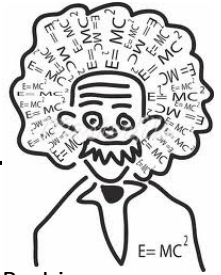
Write the three laws for static electricity; remember static electricity consists of charges trapped in a substance moving rapidly.

1.

2.

3.

Albert Einstein _____



Steps to be followed:

1. In your group have a volunteer stand on top of the plastic footstool. (No volunteers? Then Barbie doesn't mind a bad hair day)
2. **Before you turn the generator on**, place one hand palm down on the globe of the Van de Graaf.
3. **Now turn on** the Van de Graaf and wait for 1 to 2 minutes.

Note: Please make sure you do not remove your hand from the globe, touch anyone or step down from the footstool while the machine is running.

1. Describe what happens?
2. Explain which Law has been demonstrated.
3. Why did we use a plastic stool?

Glowing Light _____



Steps to be followed:

1. **Turn on** the Van de Graaf generator.
2. Hold the fluorescent light tube and approach the charged Van de Graaf generator

Note: If possible, close the lights to see the best results.

1. Describe what happens?
2. Explain which Law has been demonstrated?
3. Why did we not get electrocuted? (Hint: _____ Kills, not Voltage.)

Activity 4: Student

GIZMO: Household Energy



A: Comparing Lightbulbs

Get the Gizmo ready:

- Click **Reset all appliances**
- Check that the **BEDROOM** tab is chosen

Introduction:

Three types of light bulbs can be found in a typical household:

- Traditional light bulbs are **incandescent lamps**. In this bulb, an electric current passes through a thin tungsten filament. The filament heats up and emits light.
- In a **halogen lamp**, the filament is encased in a glass capsule containing pressurized gas. This allows the filament to be heated to higher temperatures and emit brighter light.
- In a **fluorescent lamp**, an electrical current passes through a gas inside a phosphor-coated tube. The gas emits ultraviolet radiation, which causes the phosphor to glow.

Question: Which kind of light bulb uses the least amount of energy?

1. Hypothesis: Which of the three types of lamps do you think is the most efficient?

2. Gather data: On the **BEDROOM** tab, click on the **Incandescent Light** to the left of the bed, and the **Halogen Lamp** at the foot of the bed. Record the wattage of each. Then select the **KITCHEN** tab and record the wattage of the overhead **Fluorescent Lamp**.

Incandescent lamp: _____ Halogen lamp: _____ Fluorescent lamp: _____

Appliance	Consumption (kWh)
Coffee Maker	0.66
Dishwasher	2.58
Fluorescent Light	0.24
Incandescent Light	0.3
Printer	0.6
Washer	0.63

B: Your Energy Bill

Get the Gizmo ready:

- Click **Reset all appliances**

Question: How much energy does your household consume?

1. Observe: In the Gizmo, go through the house, clicking on the different electrical appliances. Which appliances have the highest wattages? _____

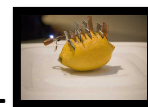
2. Hypothesis: Which household appliances do you think use the most energy in a day?

3. Gather data: Choose the USAGE tab. Select each appliance that is used in your house, and estimate its daily usage. (For appliances you use less frequently, such as the clothes dryer, think about how much it is used in a week, and then divide by seven.) Water heaters are on about 5h/day, and refrigerators are on about 8h/day. Record wattages, your daily usage estimates, and daily energy consumptions for your household in the tables below.

Room	Appliance	Wattage (kW)	Daily usage (h)	Daily consumption (kWh)
Kitchen	Refrigerator			
	Electric stove			
	Microwave oven			
	Fluorescent light			
	Dishwasher			

Activity 5: Student

Lemon Battery



Introduction:

Batteries are very useful in world today and are used to power flashlights, computers, cars, etc. As scientists, we are always looking for ways in which we can reduce our carbon footprint and come up with innovations, ideas and inventions that produce unique and environmentally friendly products. Today we are going to look at whether lemons can make a good battery or not.

Materials:

- Four to five juicy lemons
- Five copper pieces (size of dimes)
- Six wires
- An LED
- Voltmeter

Method:

1. Make a slit into each lemon approximately 3-4 inch apart.
2. In one slit, insert the copper piece. In another slit, insert the zinc nails. Make sure that the copper and zinc pieces do not touch each other.
3. Make a series circuit using lemons by connecting each lemon with the wires provided.
4. Attach the wire from copper piece of the lemon at one end to the long leg of the LED.
5. Attach the wire from zinc piece of the lemon at the other end to the short leg of the LED.
6. Observe and record the results.

Observations:

No of lemons	Prediction (Will the LED light up? YES/NO)	Voltage	LED lit up* (YES/NO)
1			
2			
3			
4			
5			

*The LED light is very dim. Observe carefully!

Discussion Questions:

1. Did your observations match your predictions? Why do you think the LED did or did not light up?
2. What was the voltage across the circuit and what does this mean in terms of electric current passing through the circuit?
3. Which metal is the anode and which metal is the cathode in this battery and which way is the flow of electrons?
4. An electrolyte is made up of free ions to help conduct electricity in batteries. What is the electrolyte in the lemon battery?

Idea taken from, http://hilaroad.com/camp/projects/lemon/lemon_battery.html